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ning a general introduction on the subjects of classification, anatomy, and physiology.

In spite of many excellences, the general part of the work is not wholly satisfactory ; it is distinctly inferior to the *Allgemeine Zoologie* of Claus, Hertwig, or Hatschek. Again, it seems to the writer unwise, both from a pedagogical and from a scientific standpoint, to erect any artificial barrier between the philosophy and history of a science and its bare results. The deadest, driest facts may be clothed with a living interest if only the historical discovery of those facts and their philosophical import are pointed out at once.

Twelve phyla of the animal kingdom are recognized instead of the classical seven of Leuckart, the modifications being the following : the Porifera are separated from the Cœlenterata ; Vermes is omitted, and in its place are three phyla, *viz.*, Platyhelminthes (including Nemertinea), Nemathelminthes (including Chætognatha), and Annullata ; a new phylum, Trochhelminthes, includes Rotifera, Dinophleia, and Gastrotricha ; Molluscoidea stands as a phylum, including Polyzoa, Phoronida, and Brachiopoda.

The first eleven phyla are treated of in the first volume of the work ; the second volume is devoted entirely to the twelfth phylum, the Chordata. Each volume is indexed and is complete in itself, and this fact may be utilized to advantage by teachers who conduct separate classes in Vertebrate and Invertebrate Zoology.

The illustrations and typography are excellent in the main. Some of the figures suffer from being copies of copies, but many of them are entirely new, and others are new to a text-book. Both the illustrations and the method of presenting the subject give a freshness to the whole work which is very attractive.

Unfortunately the work is marred by an unusually large number of errors.<sup>1</sup> This is certainly due in part to the fact that the authors were separated so far from each other and from the publishers, and perhaps also to the serious illness of the senior author, who, unfortunately, did not live to see the completion of the work.

**Some Recent Faunistic Work in Europe.** — Two papers of importance have appeared recently which deal with the fresh-water fauna of Central Europe and exemplify in some particulars the tendencies of current faunistic and systematic work in zoology. For many years Bohemia has been a center of activity in these lines, and the portable

<sup>1</sup> For a list of these errors see a review of the work in *Natural Science* for March, 1898.

biological station under the direction of Professor Frič has had a large share in this work. The latest publication from this station is a paper<sup>1</sup> which deals with the flora and fauna of two glacial lakes in the Bohemian Forest. These lakes have an altitude of 1008 and 1030 meters, and a maximum depth of 30 and 35 meters, respectively. They are characterized by rocky shores, little vegetation, and great transparency of the water. As might be expected under these conditions the fauna is scanty, including, with the adjacent land forms, only 185 species, of which but 83 are referred to the aquatic fauna. This is characterized by the presence of a number of cosmopolitan species, principally of Protozoa and Entomostraca, together with a much smaller number of alpine and arctic forms. The cosmopolitan distribution of the two groups above mentioned is shown by the fact that of 19 species of Protozoa listed for these Bohemian lakes, 13 are known to occur in this continent, and of the 24 species of Entomostraca at least 12 are found in American waters. A further evidence of the similarity of the lake fauna the world over is found in the occurrence in these alpine lakes of Bohemia of 12 species, largely limnetic, reported by Forbes<sup>2</sup> from the mountain lakes of Yellowstone Park.

These lakes of Bohemia were under observation in 1871, in '87, and again from '92-'96 at intervals during the summer months. With respect to the fauna thus observed, the authors conclude that it is not constant but changes from year to year in response to the environment, predominant forms of one year disappearing the next, it may be to return again when conditions favor. Thus the authors attribute the disappearance of *Polyphemus pediculus*, a littoral species in Schwarzersee, to the accidental lowering of water level, whereby the winter eggs were stranded on the dry shore, and the extermination of *Holopedium gibberum* from the plankton to the introduction of *Salmo salvelinus* into the lake. A single fish (32 cm.) of this species was taken which had eaten 3000 specimens of *Holopedium*. The plankton is remarkable for the paucity of species reported. In general the collections, which were not strictly quantitative, indicate an accumulation of the plankton in the upper layers and its scarcity in the deeper water, though one instance occurs of an exceptional abundance of *Daphnia ventricosa* — with summer eggs — in the

<sup>1</sup> Frič, A., und Vavra, U. Untersuchungen zweier Böhmerwaldseen, des Schwarzen und des Teufelssees. *Archiv f. Landesdurchforsch. v. Böhmen*, Bd. x (1897), Nr. 3, 74 pp., 33 figs.

<sup>2</sup> Forbes, S. A. A preliminary report on the aquatic invertebrate fauna of Yellowstone National Park, Wyoming, and of the Flathead region of Montana. *Bull. U. S. Fish Com.*, vol. xi (1893), pp. 207-258, Pls. XXXVII-XLII.

bottom water at a depth of 25 meters. The bottom ooze of the lakes is declared to be practically devoid of life.

The second paper<sup>1</sup> is issued by the Balaton Lake Commission of the Hungarian Geographical Society, as Part I of a volume dealing with the biology of this body of water, a lake containing 650 square kilometers, but having an average depth of only 3 meters and a maximum of 10. The presence of vegetation, the warm shoal water, and the variety of conditions offered in so large a body of water favor the occurrence of an extended and varied fauna. It is therefore not surprising that the zoological inventory includes 597 species reported by the specialists who have dealt with the various groups.

The introductory chapter by Dr. Entz contains a description of Daday's ingenious closable trap for bottom collections and an extended comparison of the pelagic fauna of the Balaton with that of other bodies of water which have been similarly explored. Owing to the fragmentary character of the data, precise comparisons are not possible, though in a general way it may be said that the organisms of the plankton are, as a rule, cosmopolitan in their distribution. Attention is called to the invasion of the littoral region by the plankton organisms and the depth of 1.5 meters is stated to be the limit of the purely plankton-inhabited area of Lake Balaton. That this limit cannot be generally applied must be evident. The reviewer has often found a typical plankton in water much less than a meter in depth. The character and extent of the littoral fauna, and especially of the flora, the distance from shore, and a host of environmental conditions come in to establish, obliterate, or modify the boundary lines of the limnetic and littoral areas in most bodies of fresh water. Aquatic vegetation is said to hinder the development of the plankton, and the author maintains the diurnal migration of the plankton organisms, — to the surface at night and to the deeper waters during the day. No data upon this subject are given, and it may be well in this connection to recall the results of Professor Birge's careful quantitative work<sup>2</sup> upon the movements of the *Crustacea* in Lake Mendota. In this body of water the diurnal migration, occasioned by the light, is confined to the upper meter or possibly two meters.

<sup>1</sup> Die Fauna des Balatonsees, von Dr. K. Brancsik, Dr. E. v. Daday, R. Francé, Dr. A. Lovassy, L. v. Méhely, Dr. S. v. Ratz, Dr. K. Szigethy, und Dr. E. Vángel, unter der Leitung von Dr. G. Entz. Wien, 1897. xxxix + 279 pp. 158 illustrations.

<sup>2</sup> Birge, E. A. Plankton Studies on Lake Mendota. II, The Crustacea of the Plankton, July, 1894 — December, 1896. *Trans. Wisc. Acad. Sci., Arts, and Letters*, vol. xi (1897), pp. 274-448.

The plankton of the Balaton is peculiar in its entire lack of Dinobryon and Diffugia. The fauna seems to be relatively poor in Rotifera and Entomostraca and rich in Nematoda and Protozoa, especially Flagellata. For these last particulars much credit must be given to the excellent reports of Daday and Francé. Of the Protozoa 191 species were found, 92 belonging to the oft-neglected group of Mastigophora. The bottom ooze yielded an unusual number of new forms.

With regard to the distribution of Protozoa, Francé concludes that it is not so much influenced by climatological and meteorological conditions, as by the hydrological environment and the associated vegetation. Thus he distinguishes several characteristic habitats, each having its peculiar protozoan fauna wherever found, such as (1) the peat swamp where desmids and Protococcus abound, and the green flagellates as Euglena are plentiful; here we find the Rhizopoda with patterned shell, such as Euglypha and Nebella, which feed upon the green forms mentioned; (2) decaying vegetation, where Stentor, Paramœcium, and craspeomonads occur; (3) the rush-bordered shore, where diatoms abound, and the diatomophagous Protozoa, such as Amœba, the Euglenidæ, Chilodon, Holophrya, and Amphileptus, abound; (4) the bottom ooze, resembling the shore but not so densely populated, where *Amœba verrucosa*, Arcella, and Diffugia, and small monads are to be found; (5) the sandy shore, marked by the sand building Rhizopoda, as Diffugia, and Orbulinella; (6) the rocky shore, where filamentous algæ cover the rocks and afford food and shelter for the algophilous Infusoria, such as Glaucoma and Colpoda, and for the thalamophorous Rhizopoda; (7) the open water with its typical plankton forms, such as the Peridinidæ, Codonella, Synura, and the passive limnetic Epistylis and Tokophrya. It is of interest to note that Daday finds these same habitats characterized each by its peculiar crustacean fauna. He also mentions the avoidance of the upper layers of water by the Entomostraca in the daytime and on moonlit nights, and discusses their movements with respect to light.

An interesting case of "synoikosis" is reported by Vángel in which a bryozoan, *Fredericella sultana*, is associated with a sponge, *Spongilla lacustris* or *fragilis*. There is a marked and constant agreement in the color of the two forms, the bryozoan being of a grayish, brownish, or greenish tinge according as the sponge is colored. The author suggests that the similarity in color affords mutual protection, that the tentacles of the bryozoan create currents which bring more food to the sessile sponge, and that by reason of its

likeness in color to its background the bryozoan escapes detection when extended from its capsule. From the structure of the sponge it is evident that it is not located upon the bryozoan until the latter has attained a considerable growth.

Although a considerable number of new species are described in this report, we find an occasional reduction of an old species to a synonym as a result of the examination of this fauna through several seasons, and a few incidental references to the variability of characters relied upon for specific distinctions.

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**Lake Fauna.**—The results of three summers' careful investigation of the life in a small lake in Finland are given in a faunistic-biological paper by Dr. K. E. Stenroos,<sup>1</sup> which amply proves the sufficiency of a small body of water to yield a rich fauna and to throw light on many important biological problems. Lake Nurmijärvi contains but two square kilometers, is but one meter in depth, presents a variety of shore formations, and is rich in vegetation. It is subject to considerable fluctuation in level and in temperature and to much shifting of the bottom by the ice in winter.

The author's faunal list includes 460 species, of which 157 belong to the Rotifera and 98 to the Entomostraca. The absence of nematodes, the paucity of Infusoria, and the small number of aquatic insects enumerated are probably due to the lack of especial attention to these groups, such as was given to the Rotifera. In this latter group 27 new species are described—the under surface of lily-pads having proved to be an inexhaustible source of new forms. In this list of Finland rotifers are to be found three species discovered by Jennings<sup>2</sup> in the Great Lake region of this continent. Among the Entomostraca Stenroos finds a seasonal polymorphism which renders necessary a considerable reduction in the number of species in this group. Thus from spring to autumn *Hyalodaphnia jardinii* is successively represented by forms which have been described as *H. obtusata*, *berolinensis*, *cucullata*, *kalbergensis*, and *autumnalis*. Likewise in the genus *Bosmina* the author admits but five species,

<sup>1</sup> Stenroos, K. E. Das Thierleben im Nurmijärvi-see, eine faunistisch-biologische Studie. *Acta Soc. pro Fauna et Flora Fennica*, Bd. xvii, pp. 1-259, Taf. I-III, mit einer Karte.

<sup>2</sup> Jennings, H. S. A List of the Rotatoria of the Great Lakes and of Some of the Inland Lakes of Michigan. *Bull. Mich. Fish Com.* (1894), No. 3. 34 pp., 1 pl.